Prone Ventilation of the Critically Ill Patient

Statement of Best Practice

Patients who require prone ventilation will be clinically assessed by the appropriate medical team, taking into account indications/contraindications, and performed safely through the planning process.

Introduction

Prone ventilation has been used for many years to improve oxygenation in the management of the critically unwell patient with Acute Respiratory Distress Syndrome (ARDS). The physiological benefits of prone ventilation have been well described: with improved ventilation-perfusion mismatching, recruitment of dependent lung regions and enhanced drainage of tracheobronchial secretions.

Available evidence suggests that prone positioning must be considered early in the disease process of ARDS and acute lung injury.

The optimal duration of prone ventilation has not been identified, however there is meta-analysis study [1] to suggest a fall in mortality in patients ventilated in the prone position for over 12 hours. It is therefore recommended to prone patients for a period of 12-16 hours, ideally coordinating the periods of turning with increased numbers of medical and nursing staff.

Education and Training Risk Assessment

It is recommended that those who participate with prone positioning have achieved minimum Level One of the National Competency Framework[2].

- Staff must be able to identify reasons for prone positioning
- Demonstrate knowledge and understanding of local and national policies, guidance and procedures
- Prepare equipment and finally demonstrate the correct organisational technique for the procedure

Benchmarking Group: February 2015
Review Date: February 2017

Patient Selection

There is very little evidence to support specific optimal parameters in which to institute turning patients prone, and in most cases the decision to prone ventilate is at the discretion of the consultant. The following indications may be used as a guide:

Indications: Inclusion Criteria

- Ventilated patients with Acute Respiratory Distress Syndrome (ARDS)
- FiO_2 greater than 60% and a PaO_2 / FiO_2 ratio <20kPa (150mmHg)
- PaO_2 <12 on 60% O_2
- PaO_2 <16 on 80% O_2
- A PEEP >5cmH_2O

Contraindications: Exclusion Criteria

Absolute

- Unstable spine fractures, multiple trauma, external pelvic fixation, recent chest or pelvic fractures
- Recent tracheal surgery, sternotomy or pacemaker placement

Relative

- Increase intercranial pressure
- Patients with increased intra-abdominal pressure or open abdomen
- Patients with high risk of requiring cardiopulmonary resuscitation or defibrillation (However, prone ventilation has been shown to reduce the rate of cardiac arrest in a group of patients)[3]
- Pregnancy or morbid obesity

Pre Prone Ventilation Checklist

- Procedure explained to patients and / or family
- All necessary procedures carried out prior to prone ventilation (eg. CXR, CVC insertion, vas-catheter insertion, arterial catheter insertion)
- Nurse in charge and consultant aware
- Appropriate number of staff available (minimum 5), including medical staff competent in advanced airway skills
- Allocate team roles
- Intubation trolley available at bedside
- E.T tube and invasive lines secured (Caution: E.T tubes have been reported to move during prone ventilation when using Anchorfast ties)
- Non-essential monitoring removed and minimise infusions, NG feed stopped and NGT aspirated (ECG monitoring removed ready to be placed on patients back)
- Eyes closed and secured with eye protectors / eye guards (ensure regular eye care)
- Essential equipment is available: Pillows (minimum 3 for chest, pelvis, knees), sheets, slide sheet, absorbent pads
- It is advised to use the 'pasty technique' (Two sheets, one under /one over the patient, rolled in towards the patient to produce a cocoon effect)

It is recommended that the patient should ideally be rolled towards the ventilator, unless consideration of attachments such as CVVH and infusions. The person responsible for the patient's head and airway should coordinate the procedure.

During Prone Ventilation

- Place patient in the 'swimmers' position
- Turn head towards upward reaching arm

Post Prone Ventilation Checklist

- Check position of E.T tube
- ECG electrode applied to patients back (Mirror image)
- Reconnect monitoring, infusions and NG feed
- Check ABG approximately 30 minutes following prone position
- Debrief team to identify any specific issues or difficulties
- Minimal 2-4 hourly alternating head turns during prone ventilation, ensuring E.T tube protection by medical staff competent in advanced airway skills
- Apply face protection guards according to organisational choice
- Place patient bed on 15-30° reverse "trendelenberg" for NG feeding purposes and minimise facial oedema

When the patient is ready to be returned to the supine position, please consider planning processes of pre, during and post prone ventilation checklist.

Process

The potential risks of prone ventilation can be minimised by careful logistical planning and use of a prone ventilation checklist, and the immediate availability of a skilled practitioner who could manage complications as they arise.

Ventilator Settings

- Aim for tidal volume of 6ml/kg with PEEP
- Comply with ARDS best practice ventilation guidance
- Plan to routinely adjust ventilator settings once prone ventilated to ensure ARDS compliance

Complications / Potential Risks of Prone Ventilation

At time of prone ventilation / supine positioning

- Dislodgement of E.T tube, drains, invasive catheters
- Potential for haemodynamic instability
- Reduced monitoring during movement

During prone ventilation positioning

- Blocking of E.T tube due to secretion drainage
- Raised intra-abdominal pressure, reduced absorbing of NG feed
- Pressure damage in atypical sites (nose, ears, eyes, toes, knees)

References

1. Beitler, JR., Shaefi, S., Montesi, S.B. et al (2014) '**Prone positioning reduces mortality from acute respiratory distress syndrome in the low tidal volume era: A meta-analysis'**. Intensive Care Medicine. 2014 Mar; 40 (3):332-41. Doi: 10.1007/s00134-013-3194-3.

2. CC3N: National Critical Care Competency Working Group. **National Competency Framework for Adult Critical Care Nurses: Step 1**. 2013.

3. Guérin, C., Reignier, J., Richard, J.C. et al (2013) '**Prone positioning in severe acute respiratory distress syndrome'**. New England Journal of Medicine, 368:2159-2168. Doi: 10.1056/NEJMoa121410.